Fibres and raphides in fruit of Monstera.

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(WITH PLATE X.)

Monstera deliciosa is a native of Central and South America, belonging to the Aroideæ, and closely related to the Calla. It possesses a weak, elongated, stoloniferous stem, by which it clings to rough walls, or rocks, or firmly clutches some tree by means of its numerous adventitious roots, reaching sometimes 10 to 50 feet in length or more. Its large, wide-spreading leaves, borne upon long petioles, are perforated by large elongated openings. The cylindrical fruit is an aggregate, termed by Dr. Masters a berry or sarcocarp. It is borne erect upon a long, rounded peduncle among the upper leaves of the plant, and when young is sheathed by a hood-like deciduous spathe. The fruit when mature is about 20 cm. in length by 4 cm. in diameter. Running through its center is a thick core (endocarp), surrounding which is the pulpy, edible portion. This latter part is composed of small, elongated, hexagonal segments placed side by side. Each is made up of a thick inner part (mesocarp), and of a thinner outer part (exocarp). These separate from each other in the ripened fruit. The mesocarp is the true edible portion of the fruit, and is considered by many as a great delicacy because of its pleasant characteristic flavor, slightly resembling that of the pine-apple. But the outer part of the fruit, the exocarp, is always judiciously discarded, on account of the sharp, stinging sensation produced upon the tongue and palate when it is taken into the mouth, an effect similar to that caused by weak acids.

By placing a minute part of this exocarp under the microscope, the cause of this peculiar action is at once shown. Groups of slender, sharp-pointed, needle-like cells or fibres appear half embedded in the large-celled parenchyma tissue. Careful observation brings to view a second set of needle-shaped objects, very minute, which from their regularity in shape and size may at once be recognized as crystals or raphides.

To ascertain the true nature of these raphides and fibres, chemical tests were applied, as directed by Strasburger, Goodale and de Bary, with the following results:

Acetic acid has no perceptible effect upon either form,

while hydrochloric acid dissolves the raphides without effervescence, proving them to be calcium oxalate. The fibres are proven to be lignified from their reactions with phloroglucin and hydrochloric acid, also with aniline sulphate and sulphuric acid. Treated with iodine and sulphuric acid a reddish-yellow color is produced, which confirms the above statement. Knowing that these fibres are hard-walled, lignified cells, and that they appear scattered through the parenchyma, they may therefore be placed among the sclerenchymatous tissues. Similar cells to the above, occurring in Aroideæ, Rhizophoraceæ, Nymphæaceæ, and especially those found in the leaf lamina of Monsterineæ, are termed "internal hairs" by de Bary. Concerning them he says:[1] "Numerous hairs are contained in the cavities and passages of the lamellar parenchyma. * * * * They closely resemble sclerenchymatous fibres and were therefore first described as 'bast cells' by Schleiden." Farther on he makes the statement that hard-walled hairs are fundamentally related to sclerenchymatous fibres in every respect and are special cases of the latter, distinguished by form and distribution.

On taking longitudinal sections from various parts of the plant, the fibres are found to occur in every part. But in no part are they found in so great numbers nor so perfectly developed as in the exocarp or outer portion of the fruit. Here they resemble true bast fibres, with but little branching, while in the leaf lamina and spathe, especially, they are very slender and variously branched, filling the interstices of the surrounding tissue and resembling the "internal hairs" described by de Bary.

For a general description of the fibres it may be stated that the walls are very evenly thickened, possessing no projections nor characteristic markings. They are firm in texture but not brittle as wood fibres. In length they are from .9 mm. to 1.6 mm.; in diameter from .015 mm. to .03 mm. Their contents are similar to those of the surrounding cells, but slightly granular. They occur in the parenchymatous tissue situated in the interstitial or intercellular spaces.

While the fibres differ much in size and assume a variety of shapes, due mainly to their promiscuous branching, we find the raphides to be of nearly uniform size and form. Like the fibres they occur throughout the plant in the parenchymatous tissue, but most abundantly in the fruit. Here

[1] Comp. Anat. of Phanerogams and Ferns.

they occur in countless numbers. Lying parallel with one another, they form compact bundles which are situated in narrow elongated cells, known as crystal cells. The raphides are very minute; in length from .01 mm. to .012 mm.; in diameter about .002 mm. They are many sided, with angles and faces poorly defined, and possess sharp ragged ends. In addition to raphides, isolated stellate crystals are also found in the fruit of Monstera.

Concerning the early developement of fibres, de Bary states that they arise by early outgrowth of a cell of the wall of the cavity (usually one layer of cells thick), which remains relatively narrow so as to form long, pointed arms. This explanation may be accepted as general, but it has not been satisfactorily proven in this special plant.

Finally, we may draw the conclusion that since the raphides are so minute, and form such a small quantity compared with the fibres, and since the action of calcium oxalate is very slight, the peculiar sensation caused by placing a piece of the outer fruit in the mouth must necessarily originate from the mechanical action of the sharp-pointed sclerenchymatous fibres, and not from any chemical action of the raphides.

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EXPLANATION OF PLATE X.—Fig 1. Fruit of Monstera deliciosa. Fig. 2. Section of fruit showing structure; *a*, endocarp or core; *b*, hexagonal segments or fruit proper; *x*, mesocarp or edible portion; *y*, exocarp. Fig. 3. Exocarp dissected under low power; *a*, fibers, *b*, raphides. Fig. 4. Fiber and raphides under high power. Fig. 5. Cross-section of "fruit proper;" *a*, cross-section of fibre. Fig. 6. Longitudinal section of "fruit proper;" *a*, crystal cell; *b*, parenchyma cell; *c*, fibre.

Our worst weeds.

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It is due to those who have already aided me in the study of the weed flora of the United States that some preliminary report be given. The first twenty-five lists which have been received contain in all 267 species, and represent 14 states, ranging from Massachusetts to California, and Wisconsin to Texas. As, in the present article, we are to deal with the worst weeds, attention will be confined to those which appeared at least five times in the lists. Of these there are 34 species, which will be enumerated below.